CHAITANYA BHARATI INSTITUTE OF TECHNOLOGY

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
Stake holder involvement in Curriculum Development
AY 2020-21

Action taken and implementation in Curriculum

INDEX

HEAD
DEPARTMENT OF ECE
Chaitanya Bharathi Institute of Technolog
Hyderabad-500 075

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Stakeholder involvement in Curriculum Development

AY 2020-21

Action taken and implementation in Curriculum

1) Industry

S.no.	Suggestions & opinion	Actions Taken
1	In 7th semester you could introduce "Computer Vision", the syllabus could be: 1) Descriptors/Features for image recognition like SIFT, SURF, (2 weeks) 2) Multiple view geometry and homography, etc., matrices etc (4 weeks) 3) Image registration and RANSAC (1 or 2 weeks) 4) Image classification using CNNs (one week) 5) Image retrieval using visual words and/or deep learning approaches (one lecture) 6) Object detection using DNNs (one or two lectures).	Computer Vision course is included with the suggested topics
2	Computer architecture and microprocessor lab is missing. The students may be taught how to setup Ethernet, create routing tables, establish Wi-Fi communication, implement Bluetooth and Zigbee protocols to communicate with analog and digital sensors. Establish TCP-IP or UDP protocols.	These topics are included in Computer networks course
3	Emphasis to be given more on assignments, lab work and mini projects. Mini projects may be defined for few courses like Antenna theory / Microwave theory/Embedded systems/IoT etc. However the projects to be done on single person basis to strengthen each student.	Already Included in the syllabus.
4	Surveillance: RADAR (Primary and Secondary), ADS-B, MLAT (Multilateration) ASMGCS (Advanced surface movement guidance and control system)	It is included in the syllabus.

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1) Industry (Proof)

20CS O14

FUNDAMENTALS OF COMPUTER VISION

(Open Elective-III)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: This course aims to:

1. To understand the Fundamental Concepts Related to Multi-Dimensional Signal Processing.
2. To understand Feature Extraction algorithms.
3. To understand Visual Geometric Modeling and Stochastic Optimization.

Course Outcomes: Upon completion of this course, students will be able to:

1. Recognize the basic fundamentals of vision and describe the scope of challenges.
2. Develop algorithms to analyze feature detection and feature alignment.
3. Analyze images and videos for problems such as tracking and structure from motion.
4. Choose object, scene recognition and categorization algorithms for real time images.
5. Apply various techniques to build computer vision applications.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	-	-	-	-	-	-	-	-	1	1	2	1
CO2	2	3	3	1	2	1	-	-	-	-	-	-	2	1	-
CO3	2	2	3	2	2	-	-	1	1	-	-	1	2	1	1
CO4	1	1	2	3	2	2	-	1	2	2	1	-	1	1	2
CO5	1	2	3	2	3	2	-	1	1	2	1	1	2	2	2

UNIT - I

Introduction to Computer Vision and Image Formation: Introduction, Geometric primitives and transformations, Photometric image formation, Digital Camera image formation.

Image Processing: Point operators, linear filtering, more neighborhood operators, Fourier transforms, Pyramids and wavelets, Geometric transformations.

UNIT - II

Feature detection and matching: Points and patches, Edges, Lines.

Segmentation: Active contours, Split and merge, Mean shift and mode finding, Normalized cuts.

Feature-based alignment: 2D and 3D feature-based alignment, Pose estimation.

UNIT - III

Structure from motion: Triangulation, Two-frame structure from motion, Factorization, Bundle adjustment, constrained structure and motion.

Dense motion estimation: Translational alignment, parametric motion, Spline-based motion, Optical flow, Layered motion.

UNIT - IV

Image Stitching: Motion Models, Global alignment, Sparse and dense corresponding, Global Optimization.

UNIT – V

Recognition: Object detection, Face recognition, Instance recognition, Category recognition, Context and scene understanding.

Text Books:

1. Richard Szeliski "Computer Vision: Algorithms and Applications", Springer-Verlag London Limited, 2011.
2. R. C. Gonzalez and R. E. Woods, "Digital Image Processing", Addison Wesley, 2008.

Suggested Reading:

154

HEAD
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20EC C27

COMPUTER NETWORKS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: A course on digital communications is required.

Course Objectives: This course aims to:

1. Understand the general overview of the concepts and fundamentals of computer networks.
2. Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols of the various layers.
3. Learn the Routing, congestion control algorithms and application layer protocols.

Course Outcomes: Upon completion of this course, students will be able to:

1. Relate the communication tasks with basic concept of networking, protocols and Service models at different layers and Interpret the Design issues of Data link layer using protocols and services.
2. Apply random accessing Protocols for Medium Access Control.
3. Examine the performance of network and Internetworking with routing algorithms and the congestion control approaches.
4. Understand the transport layer and Application Layer concepts.
5. Demonstrate the Application layer Protocols.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	3	1	1	1	1	1	3	3	2	3
CO2	3	3	3	3	1	2	2	2	1	2	2	3	3	2	3
CO3	3	2	3	3	1	2	2	1	2	1	2	3	3	2	3
CO4	2	2	2	3	1	2	2	2	1	2	1	3	3	2	3
CO5	3	2	3	2	1	3	2	1	2	1	1	3	3	2	3

UNIT-I

Introduction: History and development of computer networks, Network topologies, Types of Networks: PAN, LAN, MAN, WAN. Network software, OSI, TCP/IP Reference models, Example Networks: ARPANET, Internet.

Data Link Layer: Design issues, framing, Error detection and correction. Elementary data link protocols: simplex protocol, A simplex stop and wait protocol for an error-free channel, A simplex stop and wait protocol for noisy channel. Sliding Window protocols: A one-bit sliding window protocol, A protocol using Go-Back-N, A protocol using Selective Repeat, Example data link protocols - HDLC, the data link layer in the internet.

UNIT-II

Medium Access sub layer: The channel allocation problem, Multiple access protocols: ALOHA, Carrier sense multiple access protocols, collision free protocols. Concepts of Local Area Networking technologies such as Zigbee, BT, WLAN. Data link layer switching. Ethernet, Data Link Layer switching, Wireless LAN. Broadband Wireless, Bluetooth

113

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UNIT-III

Network Layer: Design issues, Routing algorithms: shortest path routing, Flooding, Hierarchical routing, Broadcast, Multicast, distance vector routing, Congestion Control Algorithms, Quality of Service, Internetworking, the Network layer in the internet (IPv4 and IPv6).

UNIT-IV

Transport Layer: Transport Services, Elements of Transport protocols, Internet transport layer protocols: UDP and TCP.
Application Layer: Domain Name System, electronic mail, World Wide Web: architectural overview, dynamic web document and HTTP.

UNIT-V

Application Layer Protocols: Simple Network Management Protocol, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet.

Text Books:

1. Andrew Tanenbaum and D. Wetherall, "Computer networks", 5th Edition, Prentice-Hall, 2011.
2. J.F. Kurose and K. W. Ross, "Computer Networking – A top-down approach featuring the Internet", Pearson Education, 3rd Edition, 2005.
3. William Stallings, "Data and computer communications", Prentice Hall, 8th Edition,2007.

Suggested Reading:

1. B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, 4th Edition,2007.
2. L. Peterson and B. Davie, "Computer Networks – A Systems Approach", Elsevier Morgan Kaufmann Publisher, 5th Edition, 2011.
3. S. Keshav, "An Engineering Approach to Computer Networking", Pearson Education, 2nd Edition, 2001.

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20ECC26

MINI PROJECT

Instruction	2P Hours per Week
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	1

Prerequisite: Knowledge of Electronic circuits and Communication systems

Course Objectives: This course aims to:

1. To enable students learning by practical realization.
2. To develop capability to analyse and solve real world problems.
3. To develop technical writing and presentation skills.

Course Outcomes: Upon completion of this course, students will be able to:

1. Formulate mini project proposal through literature survey.
2. Plan, design and analyze the proposed mini project.
3. To simulate and execute the mini project for validation.
4. Enhance oral presentation skills.
5. Prepare and submit the mini project report.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	2	3	2	2	-	2	1	1	3	-	2	3	2	3	2
CO2	1	3	2	2	-	-	-	-	3	-	1	2	1	3	2
CO3	-	2	1	2	2	-	-	-	3	-	-	-	-	2	1
CO4	-	-	-	-	-	-	-	-	3	3	1	-	-	-	-
CO5	-	-	-	1	-	-	-	-	3	3	1	-	-	-	-

The students are required to choose emergent technology topic for mini project related to domain. The students have to design and simulate/ implement as per the given schedule. Students have to give oral presentation in presence of department review committee, finally report of the mini project work has to be submitted for evaluation.

Schedule

S. no	Description	Duration
1	Problem identification/selection	2 weeks
2	Preparation of abstract	1 Week
3	Design, implementation and testing of the project	7 Weeks
4	Documentation and mini project presentation	4 Weeks

Guidelines for the Evaluation

S. no	Description	Maximum Marks
1	Weekly Assessment	20
2	PPT preparation	5

107

20EC C28

MICROWAVE AND RADAR ENGINEERING

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Knowledge of Electromagnetics and Antennas

Course Objectives: This course aims to:

1. To understand the importance of microwaves and their applications.
2. To understand the principle and operation of microwave sources.
3. To understand principle and operation of different radar systems.

Course Outcomes: Upon completion of this course, students will be able to:

1. Apply the wave equations and their solutions to analyze the waves in the waveguides.
2. Determine the scattering matrix for various microwave components.
3. Analyze the interaction of electron beam and RF field for various microwave sources.
4. Examine the principles of operation of pulse, CW and MTI radar system.
5. Compare different types of tracking radars.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	-	2	2	2	-	2	1	1	3	3	2
CO2	3	3	2	2	1	1	1	1	1	-	1	1	3	2	2
CO3	3	3	3	2	1	2	2	2	1	1	2	2	3	2	2
CO4	3	3	2	2	2	1	1	1	1	1	1	2	3	2	2
CO5	3	2	2	2	1	2	-	-	-	-	-	1	3	2	2

Unit-I

Introduction to Microwaves: Microwave frequency spectrum, Advantages and Applications of Microwaves.
Rectangular Waveguides: Rectangular waveguides, TM and TE waves, Impossibility of TEM wave in waveguides. Wave Impedance. Circular Wave guides Concepts.
Microwave Cavities: Rectangular and Circular Cavity Resonators, Quality factor and applications of cavity resonators.

Unit-II

Microwave Circuits and Components: Concept of microwave hybrid circuit, Introduction to scattering parameters. Properties and S-parameters of reciprocal components – E and H Plane Tees, Magic Tee, Directional Coupler.
Non Reciprocal Components: Ferrites – Composition and Faraday Rotation; Ferrite Components – Isolators, Gyrators and Circulators. S- Parameters of Isolator and Circulator.

Unit-III

Microwave Tubes: Limitations of Conventional Tubes at Microwave Frequencies. Principles of Gunn Diode.
O-type tubes: Two cavity klystron, velocity modulation process, bunching process. Output power and efficiency. Reflex Klystron-Velocity Modulation, Power out and efficiency, Electronic admittance.

115

Helix TWT: Slow Wave Structures, Principles of Operation and Applications of TWT (qualitative treatment only). Concepts of Magnetron.

Unit- IV

Radar Systems: Introduction to radar, radar block diagram, and operation, radar frequencies, Applications of radar, Radar range Equation, Prediction of range performance, minimum detectable signal, receiver noise, probability density function, SNR, Integration of radar pulses, radar cross-section of targets, PRF and range ambiguities, transmitter power, system losses.

Unit-V

Radar Types: Doppler effect, CW radar, FM CW radar, multiple frequencies CW radar. MTI radar, delay line canceller, range-gated MTI radar, blind speeds, staggered PRF. Principles of Tracking radar. Concepts of SAR and its applications Fundamentals of EMI and EMC, Surveillance Radar, Applications and Advantages. Introduction to Electronic warfare: ECM and ECCM.

Text Book:

1. Samuel Y. Liao, "Microwave Devices and Circuits", 3/e, Pearson Education, 2003.
2. Merril. I. Skolnik, "Introduction to Radar Systems", 2/e, MGH, 2001.
3. V. Prasad Kodali, Engineering Electromagnetic Compatibility: Principles, Measurements, and Technologies, Wiley-IEEE Press, IEEE, 2001

Suggested Readings:

1. Rizzi P, "Microwave Devices and Circuits", 3/e, Pearson Education, 2003.

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2) Alumni

S.no.	Suggestions & opinion	Action taken
1	Probability & statistics and Linear algebra are very important for any field during and after bachelors, I hope it is covered in applied mathematics. If not it's better to add those courses (topics) in the syllabus (course).	Probability & statistics and Random variables & Random Process are already included in Mathematics and Analog Communication courses. PTSP as separate course will be included in the next regulation as decided in 9th BoS meeting
2	Reduce courses and increase practical's, projects, self-learning, internships	Internships are made mandatory and weightage for project is increased. Encouraging students for self-learning through MOOCs. Mini Project is introduced in VI Sem.
3	Employability Skills – instead also develop entrepreneurship.	Entrepreneurship course is there as open elective

2) Alumni (Proof)

20ECC08

ANALOG COMMUNICATION

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: A prior knowledge of signals and systems is required.

Course Objectives:
This course aims to:
1. Introduce the fundamentals of analog communication.
2. Provide the design details of various transmitters and receivers used in analog communication system.
3. Involve the students in analyzing performance of communication system by estimating noise.

Course Outcomes:
Upon completion of this course, students will be able to:
1. Understand the various linear and nonlinear modulation schemes.
2. Design various transmitters and receivers.
3. Assess a random signal by computing various statistical properties.
4. Evaluate the performance of analog communication system through the estimation of noise.
5. Infer the concepts of various pulse modulation schemes.

Mapping of Course Outcomes with Program Outcomes and Program Specific Outcomes:

CO \ PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	1	0	2	3	3	1	3	2	2	3	2	2
CO2	3	3	3	3	0	3	3	3	1	3	3	3	3	2	2
CO3	3	3	3	3	0	3	3	0	0	3	3	3	3	1	1
CO4	3	3	3	3	0	3	3	3	1	3	3	3	3	2	2
CO5	3	3	3	1	0	2	3	3	1	3	2	2	3	2	2

UNIT – I
Linear Modulation Schemes:
Need for Modulation, Double Side Band Suppressed Carrier Modulation, Balanced Modulator, Coherent Detector and Costas Detector. Conventional Amplitude Modulation, Phasor Diagram of AM, Switching Modulator, Envelope Detector. Hilbert Transform and its Properties. Single Side Band Modulation. Vestigial Side Band Modulation.

UNIT – II
Non-Linear Modulation Schemes:
Angle Modulation, Frequency Modulation and Phase modulation, Concept of Instantaneous Phase and Frequency. Types of FM modulation: Narrow Band FM and Wide Band FM. FM Spectrum in Terms of Bessel Functions. Phasor Diagram of NBFM. Direct and Indirect (Armstrong's) methods of FM Generation. Foster–Seeley Discriminator for FM Detection. Introduction to PLL.

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UNIT – III

Transmitters and Receivers:

High Level and Low Level AM Transmitters. Principle and Operation of Tuned Radio Frequency receiver and Super Heterodyne Receivers. Selection of RF Amplifier. Choice of Intermediate Frequency. Image Frequency and its Rejection Ratio, Receiver Characteristics: Sensitivity, Selectivity, Fidelity. Double Spotting, Pre-emphasis and De-emphasis.

UNIT – IV

Random Variables and Random Process: Concept of random variable, Uniform Random Variable, Gaussian Random Variable. Random Process: Concept of random process, Stationarity and Ergodicity, Auto Correlation and its Properties, Power Spectral Density and its Properties. Linear System with Random inputs: Random Signal Response of Linear System, Auto Correlation of Response.

UNIT – V

Noise: Thermal Noise. White Noise. Noise Temperature. Noise in Two-Port Network: Noise Figure, Equivalent Noise Temperature and Noise Bandwidth. Noise Figure and Equivalent Noise Temperature for Cascaded Stages. Figure of Merit Calculations for AM, DSB-SC and SSB systems. Pulse Analog Modulation Schemes: PAM, PWM and PPM. Generation and detection of PAM, PWM and PPM.

Text Books:

1. Simon Haykin, "Communication Systems",2nd Edition, Wiley India,2011.
2. Herbert Taub, Donald L. Shilling & Goutam Saha, "Principles of Communication Systems", 3rd Edition, TMH, 2008.
3. Peyton Z. Peebles JR., "Probability Random Variables and Random Signal Principles", Tata McGraw Hill, 4th Edition, 2002.

Suggested Reading:

1. Singh, R.P. and Sapre, S.D., "Communication Systems", TMH, 2007.

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AICTE Model Curriculum with effect from AY 2022-23

B.E (Electronics and Communication Engineering)

SEMESTER – V

S.no	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	20ECC15	Computer Architecture and Microprocessors	3	-	-	3	40	60	3
2	20ECC16	Digital Communication	3	-	-	3	40	60	3
3	20ECC17	Digital Signal Processing	3	-	-	3	40	60	3
4	20ECC18	Linear and Digital Integrated Circuits	3	-	-	3	40	60	3
5	20MBC01	Engineering Economics and Accountancy	3	-	-	3	40	60	3
6		Professional Elective-I	3	-	-	3	40	60	3
7		Professional Elective-II	2	-	-	3	40	60	2
PRACTICALS									
8	20ECC19	Digital Communication Lab	-	-	2	3	50	50	1
9	20ECC20	Digital Signal Processing Lab	-	-	2	3	50	50	1
10	20ECC21	Linear and Digital Integrated Circuits Lab	-	-	2	3	50	50	1
11	20ECI02	Industrial/Rural Internship	3-4 Weeks/90 Hours				50	-	2
Total			20	-	06	30	480	570	23+2
Clock Hours Per Week: 26									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

5

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE Model Curriculum with effect from AY 2022-23

B.E (Electronics and Communication Engineering)

SEMESTER – VI

S.no	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	20ECC22	Microcontrollers	3	-	-	3	40	60	3
2	20ECC23	VLSI Design	3	-	-	3	40	60	3
3		Professional Elective-III	3	-	-	3	40	60	3
4		Professional Elective-IV	3	-	-	3	40	60	3
5		Professional Elective-V	3	-	-	3	40	60	3
6		Open Elective-I	3	-	-	3	40	60	3
PRACTICALS									
7	20ECC24	Electronic Design and Automation Lab	-	-	2	3	50	50	1
8	20ECC25	Microcontrollers Lab	-	-	2	3	50	50	1
9	20ECC26	Mini Project	-	-	2	-	50	-	1
10	20EGC03	Employability Skills	-	-	2	3	50	50	1
Total			**18**	**-**	**8**	**27**	**440**	**510**	**22**
Clock Hours Per Week: 26									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

49

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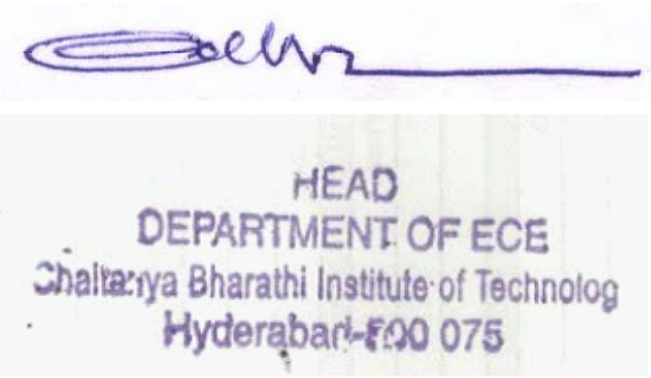
3) Parent

S.no.	Suggestions &opinion	Action Taken
1	Introduction to Electronic Warfare	It is included in MW & R
2	Introduction to Signal intelligence systems	
3	Include application oriented and Industry related topics.	Application oriented and Industry related topics are included.
4s	Not only for the upcoming batches, but even for the current batch I would suggest an increase in the industry interactions and provide more opportunities in the field of ECE for both placements, internships and guided projects	Internship is made mandatory

3) Parent (Proof)



20EC C28

MICROWAVE AND RADAR ENGINEERING

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Knowledge of Electromagnetics and Antennas

Course Objectives: This course aims to:
1. To understand the importance of microwaves and their applications.
2. To understand the principle and operation of microwave sources.
3. To understand principle and operation of different radar systems.

Course Outcomes: Upon completion of this course, students will be able to:
1. Apply the wave equations and their solutions to analyze the waves in the waveguides.
2. Determine the scattering matrix for various microwave components.
3. Analyze the interaction of electron beam and RF field for various microwave sources.
4. Examine the principles of operation of pulse, CW and MTI radar system.
5. Compare different types of tracking radars.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	-	2	2	2	-	2	1	1	3	3	2
CO2	3	3	2	2	1	1	1	1	1	-	1	1	3	2	2
CO3	3	3	3	2	1	2	2	2	1	1	2	2	3	2	2
CO4	3	3	2	2	2	1	1	1	1	1	1	2	3	2	2
CO5	3	2	2	2	1	2	-	-	-	-	-	1	3	2	2

Unit-I

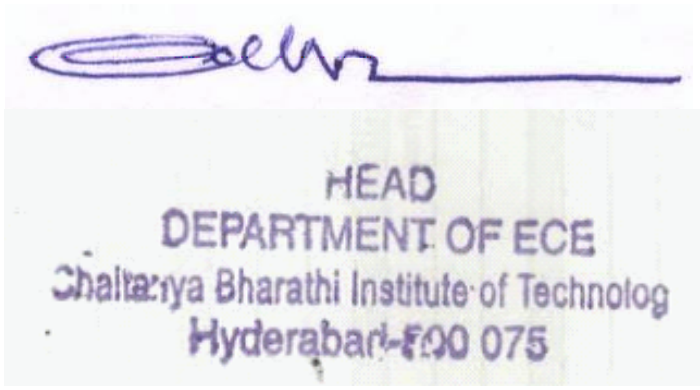
Introduction to Microwaves: Microwave frequency spectrum, Advantages and Applications of Microwaves.
Rectangular Waveguides: Rectangular waveguides, TM and TE waves, Impossibility of TEM wave in waveguides. Wave Impedance. Circular Wave guides Concepts.
Microwave Cavities: Rectangular and Circular Cavity Resonators, Quality factor and applications of cavity resonators.

Unit-II

Microwave Circuits and Components: Concept of microwave hybrid circuit, Introduction to scattering parameters. Properties and S-parameters of reciprocal components – E and H Plane Tees, Magic Tee, Directional Coupler.
Non Reciprocal Components: Ferrites – Composition and Faraday Rotation; Ferrite Components – Isolators, Gyrators and Circulators. S- Parameters of Isolator and Circulator.

Unit-III

Microwave Tubes: Limitations of Conventional Tubes at Microwave Frequencies. Principles of Gunn Diode.
O-type tubes: Two cavity klystron, velocity modulation process, bunching process. Output power and efficiency. Reflex Klystron-Velocity Modulation, Power out and efficiency, Electronic admittance.



20EC C28

MICROWAVE AND RADAR ENGINEERING

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2. Determine the scattering matrix for various microwave components.
3. Analyze the interaction of electron beam and RF field for various microwave sources.
4. Examine the principles of operation of pulse, CW and MTI radar system.
5. Compare different types of tracking radars.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	-	2	2	2	-	2	1	1	3	3	2
CO2	3	3	2	2	1	1	1	1	1	-	1	1	3	2	2
CO3	3	3	3	2	1	2	2	2	1	1	2	2	3	2	2
CO4	3	3	2	2	2	1	1	1	1	1	1	2	3	2	2
CO5	3	2	2	2	1	2	-	-	-	-	-	1	3	2	2

Unit-I

Introduction to Microwaves: Microwave frequency spectrum, Advantages and Applications of Microwaves.
Rectangular Waveguides: Rectangular waveguides, TM and TE waves, Impossibility of TEM wave in waveguides. Wave Impedance. Circular Wave guides Concepts.
Microwave Cavities: Rectangular and Circular Cavity Resonators, Quality factor and applications of cavity resonators.

Unit-II

Microwave Circuits and Components: Concept of microwave hybrid circuit, Introduction to scattering parameters. Properties and S-parameters of reciprocal components – E and H Plane Tees, Magic Tee, Directional Coupler.
Non Reciprocal Components: Ferrites – Composition and Faraday Rotation; Ferrite Components – Isolators, Gyrators and Circulators. S- Parameters of Isolator and Circulator.

Unit-III

Microwave Tubes: Limitations of Conventional Tubes at Microwave Frequencies. Principles of Gunn Diode.
O-type tubes: Two cavity klystron, velocity modulation process, bunching process. Output power and efficiency. Reflex Klystron-Velocity Modulation, Power out and efficiency, Electronic admittance.

115

Helix TWT: Slow Wave Structures, Principles of Operation and Applications of TWT (qualitative treatment only). Concepts of Magnetron.

Unit- IV

Radar Systems: Introduction to radar, radar block diagram, and operation, radar frequencies, Applications of radar, Radar range Equation, Prediction of range performance, minimum detectable signal, receiver noise, probability density function, SNR, Integration of radar pulses, radar cross-section of targets, PRF and range ambiguities, transmitter power, system losses.

Unit-V

Radar Types: Doppler effect, CW radar, FM CW radar, multiple frequencies CW radar. MTI radar, delay line canceller, range-gated MTI radar, blind speeds, staggered PRF. Principles of Tracking radar. Concepts of SAR and its applications Fundamentals of EMI and EMC, Surveillance Radar, Applications and Advantages. Introduction to Electronic warfare: ECM and ECCM.

Text Book:

1. Samuel Y. Liao, "Microwave Devices and Circuits", 3/e, Pearson Education, 2003.
2. Merril. I. Skolnik, "Introduction to Radar Systems", 2/e, MGH, 2001.
3. V. Prasad Kodali, Engineering Electromagnetic Compatibility: Principles, Measurements, and Technologies, Wiley-IEEE Press, IEEE, 2001

Suggested Readings:

1. Rizzi P, "Microwave Devices and Circuits", 3/e, Pearson Education, 2003.

116

20EC E34

IOT AND ITS APPLICATIONS

(Professional Elective - VI)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Knowledge of Programming and Problem Solving, Computer Organization, and Embedded systems.

Course Objectives: This course aims to:

1. Provide an insight into the required infrastructure for IoT technology.
2. Introduce Python Programming language and familiarize the IoT concepts, their origin, and methodology.
3. Develop Django Framework and domain-specific applications.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the terminology, enabling technologies, and various protocols of IoT.
2. Illustrate the concepts of Machine to Machine, SDN, and NFV and build simple IoT systems using Raspberry Pi board, NodeMCU, and BeagleBone Black.
3. Apply the basics of Python programming language, which is used in many IoT devices.
4. Create the steps involved in IoT system design methodology.
5. Develop web applications using a python-based framework called Django and IoT technologies for domain-specific applications.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	3	-	-	-	1	-	-	-	-	2	2	2
CO2	2	2	2	2	2	-	-	1	-	-	-	-	2	2	2
CO3	2	3	2	2	-	-	-	1	-	-	-	-	2	3	2
CO4	2	2	2	2	-	-	-	1	-	-	-	-	2	2	2
CO5	3	2	3	3	3	-	2	3	-	-	-	3	3	2	3

UNIT-I

Introduction and Concepts: Introduction to Internet of Things, Definitions and Characteristics of IoT, Physical Design of IoT: Things in IoT, IoT Protocols, Concepts of zigbee, BT. Logical Design of IoT, IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies, Wireless Sensor Networks, Cloud Computing, Big Data, Communication Protocols, IoT Levels & Deployment Templates.

UNIT-II

MACHINE TO MACHINE and Networking: Introduction, MACHINE TO MACHINE, Differences between IoT and MACHINE TO MACHINE, Software Defined Networking, Network Function Virtualization.

IoT Physical Devices and End Points: Basic building blocks of an IoT device, Raspberry Pi- about the Raspberry Pi board, Raspberry Pi interfaces- Serial, SPI & I2C, Introduction to NodeMCU, Introduction to BeagleBone Black.

UNIT-III

Introduction to Python: Motivation for using Python for designing IoT systems, Language features of Python, Data types: Numbers, Strings, Lists, Tuples, Dictionaries, Type Conversions, Data Structures: Control of flow-if, for, while, range, break/continue, pass, functions, modules, packaging, Python packages of Interest for IoT: JSON, XML, HTTPLib, URLLib, SMTPLib.

123

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Hyderabad-500 075

UNIT-IV

IoT Platforms Design Methodology: Introduction, IoT Design Methodology Steps-Purpose and Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification, Device and Component Integration, Application Development, Case Study on IoT System for Weather Monitoring.

UNIT-V

IoT Physical Servers and Cloud Offerings: Introduction to cloud storage models and Communication APIs, WAMP: AutoBahn for IoT, Xively cloud for IoT.

Python Web Application Framework: Django Framework-Roles of Model, Template, and View

Domain-Specific IoTs: IoT applications for Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, health, Lifestyle, and introduction to IIoT.

Text Books:

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things - A Hands-on Approach", Universities Press, 2015.
2. Tony Gaddis, "Starting out with Python", 3rd edition, Pearson, 2015.

Suggested Reading:

1. Francis da Costa, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st edition, press Publications, 2013.
2. Matt Richardson, Shawn Wallace, O'Reilly, "Getting Started with Raspberry Pi", SPD, 2014.
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", 1st edition, 2017

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20EC E06

PRINCIPLES AND APPLICATIONS OF AI

(Professional Elective-I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Knowledge of probability, Linear Algebra, Data Structure and programming.

Course Objectives: This course aims to:

1. Exposure to the foundation of Artificial Intelligence.
2. Familiarize the applications of Artificial Intelligence in Industry
3. Inculcate the concepts of Neural Networks and Pattern Recognition

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the basics of AI and intelligent agents.
2. Apply Expert Systems to solve real time problems
3. Understand knowledge representation methods.
4. Build algorithms using neural network techniques for various applications
5. Solve the various classification problems like object recognition

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	1	1	-	-	-	-	1	3	-	-
CO2	3	3	3	2	2	3	2	1	2	-	1	2	3	1	-
CO3	3	3	-	3	1	1	1	-	-	-	-	1	3	-	-
CO4	3	3	3	2	2	1	1	-	1	-	-	1	3	1	-
CO5	3	3	3	3	1	3	2	1	2	-	-	1	3	2	-

UNIT-I

Introduction to AI and Intelligent Agents: Concept of AI, current status of AI, Agents, Good Behavior: Environment, problem formulation. The structure of agents. Basic concepts of Search Algorithms: Uninformed depth first search, breadth first search, uniform cost search, depth limited search, iterative deepening search and informed search techniques like greedy best first search and A* algorithm, concepts of admissibility.

UNIT-II

Knowledge representation: Bayesian network representation, Construction and inference. Hidden Markov Model Approaches to knowledge representation, knowledge representation using the semantic network, extended semantic networks for Knowledge representation, knowledge representation using frames.

UNIT-III

Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems, Rule-based expert systems, blackboard systems truth maintenance systems and application of expert systems.

UNIT-IV

Neural Networks: What is a neural network, the human brain, models of a neuron, neural networks as a directed graph, feedback and network architectures. Learning processes and learning tasks.

27

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE Model Curriculum with effect from AY 2023-24

B.E (Electronics and Communication Engineering)

SEMESTER – VII

S.no	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	20ECC27	Computer Networks	3	-	-	3	40	60	3
2	20ECC28	Microwave and Radar Engineering	3	-	-	3	40	60	3
3		Professional Elective-VI	3	-	-	3	40	60	3
4		Open Elective-II	3	-	-	3	40	60	3
5	20EGM04	Gender Sensitization	2	-	-	2	-	50	Non-Credit
PRACTICALS									
6	20ECC29	Computer Networks Lab	-	-	2	3	50	50	1
7	20ECC30	IoT and Simulation Lab	-	-	2	3	50	50	1
8	20ECC31	Microwave Engineering Lab	-	-	2	3	50	50	1
9	20ECC32	Project: Part-1	-	-	4	-	50	-	2
10	20ECI03	Industrial Internship	5-6 Weeks/135 Hours				50	-	3
Total			14	-	10	23	410	440	17+3
Clock Hours Per Week: 24									

L: Lecture D: Drawing CIE: Continuous Internal Evaluation

T: Tutorial P: Practical/Project Seminar/Dissertation SEE: Semester End Examination

111

4) Professional Societies

S.no.	Suggestions & opinion	Action Taken
1	Professional elective 2 [5th sem] please change the title as CMOS Analog IC Design instead of Analog IC Design	It has been changed

4) Professional Societies (proof)

20EC E07

CMOS Analog IC Design

(Professional Elective-II)

Instruction	2L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

Pre-requisites: Knowledge of basic circuit theory and Electronic Devices and circuits.

Course objectives: This course aims to:

1. The MOS characteristics, second order effects in MOSFET and MOS modelling.
2. The design and analysis of single stage and differential MOS Amplifiers.
3. The frequency response and noise analysis of the Amplifiers.

Course Outcomes: After completion of this course, students will be able to:

1. Recall the elementary concepts of MOS device, MOS amplifiers, Current Mirrors, frequency response and noise.
2. Classify different types of MOS devices, MOS amplifiers and current mirrors.
3. Analyze (analytically) a given amplifier circuit for extracting parameters like gain, impedance, bandwidth, noise, etc.
4. Design an amplifier or it's subcomponent as per the given specification.
5. Justify with sufficient trade-off the use of an appropriate amplifier or subcomponent for a given specification.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	1	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	3	3	-
CO4	3	2	3	1	-	-	-	-	-	-	-	-	3	3	3
CO5	3	3	2	3	-	-	-	-	-	-	-	3	3	3	3

UNIT I

MOS and it's Characteristics: Introduction to analog design, Basics of MOS device Physics: MOS as a Switch, MOS structure, MOS symbols, threshold voltage, derivation of MOS VI Characteristics, Second order effects, MOS parasitic capacitances overview, MOS small signal model, long channel vs short channel MOSFET.

UNIT II

Single stage MOS amplifiers: Basic concept of Amplifier, common source stage with resistive load, common source stage with diode load, common source stage with current source load, common source stage with source degeneration, Source follower, common gate stage, cascode stage, folded cascode.

UNIT III

Current mirrors: Basic Current Mirrors, Cascode Current Mirror (Gain , Output Resistance), Bipolar Current Mirrors, High out Impedance Current Mirrors - Cascode Gain Stage, Wilson current mirror, Source degenerated current mirrors, MOS amplifiers using Current Mirror as load.

29

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

AICTE Model Curriculum with effect from AY 2022-23

B.E (Electronics and Communication Engineering)

SEMESTER – V

List of Courses in Professional Elective-I		List of Courses in Professional Elective-II	
Course code	**Title of the Course**	**Course code**	**Title of the Course**
20ECE01	CAD for VLSI Verification	20ECE07	CMOS Analog IC Design
20ECE02	Optical Communication	20ECE08	Mobile Cellular Communication
20ECE03	Signal Detection Techniques	20ECE09	Biomedical Signal processing
20ECE04	Embedded C Programming	20ECE10	Sensors and Actuators
20ECE05	Software Defined Radio	20ECE11	Drones and Applications
20ECE06	Principles and Applications of AI	20ECE12	Fundamentals of Cloud Computing

6

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5) Faculty

S.no	Suggestions/Feedback	Action Plan
1	Include mini Project in the curriculum	It is included in the syllabus.

5) Faculty (Proof)

20ECC26

MINI PROJECT

Instruction	2P Hours per Week
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	1

Prerequisite: Knowledge of Electronic circuits and Communication systems

Course Objectives: This course aims to:

1. To enable students learning by practical realization.
2. To develop capability to analyse and solve real world problems.
3. To develop technical writing and presentation skills.

Course Outcomes: Upon completion of this course, students will be able to:

1. Formulate mini project proposal through literature survey.
2. Plan, design and analyze the proposed mini project.
3. To simulate and execute the mini project for validation.
4. Enhance oral presentation skills.
5. Prepare and submit the mini project report.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	2	3	2	2	-	2	1	1	3	-	2	3	2	3	2
CO2	1	3	2	2	-	-	-	-	3	-	1	2	1	3	2
CO3	-	2	1	2	2	-	-	-	3	-	-	-	-	2	1
CO4	-	-	-	-	-	-	-	-	3	3	1	-	-	-	-
CO5	-	-	-	1	-	-	-	-	3	3	1	-	-	-	-

The students are required to choose emergent technology topic for mini project related to domain. The students have to design and simulate/ implement as per the given schedule. Students have to give oral presentation in presence of department review committee, finally report of the mini project work has to be submitted for evaluation.

Schedule

S. no	Description	Duration
1	Problem identification/selection	2 weeks
2	Preparation of abstract	1 Week
3	Design, implementation and testing of the project	7 Weeks
4	Documentation and mini project presentation	4 Weeks

Guidelines for the Evaluation

S. no	Description	Maximum Marks
1	Weekly Assessment	20
2	PPT preparation	5

107

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Hyderabad-500 075

6) Students

S.no	Suggestions/Feedback	Action Plan
1	Include mini Project in the syllabus	Mini Project is included

6) Students (Proof)

20ECC26

MINI PROJECT

Instruction	2P Hours per Week
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	1

Prerequisite: Knowledge of Electronic circuits and Communication systems

Course Objectives: This course aims to:

1. To enable students learning by practical realization.
2. To develop capability to analyse and solve real world problems.
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Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	2	3	2	2	-	2	1	1	3	-	2	3	2	3	2
CO2	1	3	2	2	-	-	-	-	3	-	1	2	1	3	2
CO3	-	2	1	2	2	-	-	-	3	-	-	-	-	2	1
CO4	-	-	-	-	-	-	-	-	3	3	1	-	-	-	-
CO5	-	-	-	1	-	-	-	-	3	3	1	-	-	-	-

The students are required to choose emergent technology topic for mini project related to domain. The students have to design and simulate/ implement as per the given schedule. Students have to give oral presentation in presence of department review committee, finally report of the mini project work has to be submitted for evaluation.

Schedule

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Guidelines for the Evaluation

S. no	Description	Maximum Marks
1	Weekly Assessment	20
2	PPT preparation	5

107

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